SOME ENVIRONMENTAL FACTORS GOVERNING THE DISTRIBUTION OF TERRESTRIAL CAVE ANIMALS*

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Highly specialized obligatory cave animals (troglobites) live in the relatively young lava tubes in the Hawaiian Islands. They evolved from representatives of the speciating native fauna by the process of adaptive shifts much as other animals have adapted to exploit novel habitats. The deep cave zone where these animals are found is seen as a rigorous or harsh environment that is perpetually dark, nearly isothermal, nearly constantly saturated with water vapor, and without many of the temporal environmental cues used by surface species. Also, the ecosystem often appears food limited. The most critical environmental factor determining the distribution of troglobites within inhabitable caves appears to be the stable saturated atmosphere. I postulate that, in adapting to exploit the rigorous cave environment, terrestrial troglobites have had to cope with a water surplus and have become more like aquatic organisms in their water balance mechanisms. In order to test this hypothesis three hygrothermographs and six modified piche atmometers were used to gather climatic data simultaneously from the twilight, transition, and deep cave zones of Charcoal Cave in Hawaii Volcanoes National Park. As expected, the evaporation data correlated with the distribution of specialized cave animals as well as with the average saturation deficit. The drops in relative humidity in the cave correlated with the curve of the absolute humidity on the surface. These relative humidity changes attenuated with distance into the cave and were reinforced by the drop of the surface temperature below the cave temperature.

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* Abstract